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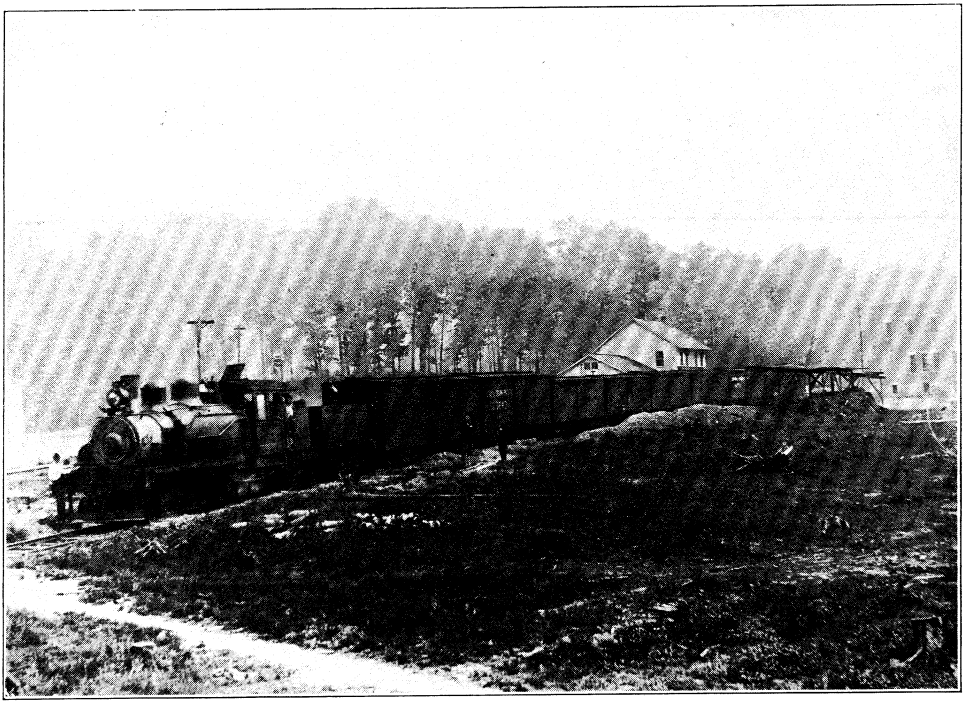
Logging, Plantation, Mining, Industrial & Standard Railroad Motive Power.

SHAY Locomotives



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Lima, Ohio

THE LOCOMOTIVE WORLD

VOL. 7, No. 9 | LIMA, OHIO | January, 1915

THE LOCOMOTIVE WORLD

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THE FRANKLIN TYPE AND PRINTING COMPANY

H. C. HAMMACK, Editor

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STEAM LOCOMOTIVES OF TODAY

THE sub-committee of the railroad committee of the American Society of Mechanical Engineers prepared a report on the above subject which was presented at the annual meeting held at the rooms of the society, 29 West 39th Street, New York City on Wednesday, December 2nd, 1914. The report in full is given below:

Recent progress and improvement in the efficiency and capacity of steam locomotives has been of such remarkable character and extent that a record in the proceedings of this society is justified.

Steam and electric locomotives as rivals in the same field has been a favorite subject for discussion before engineering societies, and it is easy to start arguments in favor of each of these rivals among the partisans interested. Whether or not the steam locomotive is to be displaced by the electric is, of course, an important question which will in time be settled by the court that settles all such questions, that of the treasurer's figures. For the present and for the immediate future the burden of transportation falls and will continue to fall upon the steam locomotive. If the steam locomotive is to be perpetuated it is fitting that it should be improved to the utmost limit. If it is to be finally displaced it is fitting that is shall be so improved in order that progress to something better shall be intelligently developed upon a solid foundation. This discussion will be confined to the steam locomotive, its progress in the recent past, and its possibilities for the near furture.

PROGRESS IN CAPACITY

While efforts individual in character and extent were made in this country before that time, the first consistent and systematic plan to secure the utmost power of locomotives within given restrictions of weight and cross-section clearance was inaugurated 20 years ago. This plan began with an eight-wheel or American type passenger locomotive, built for an eastern railroad in January, 1895. This locomotive weighted 116,000 lbs., with 74,500 lbs. on driving wheels. It provided a tractive effort of 21,290 lbs. While this locomotive was not the most powerful in passenger service at that time, it was the first of a chain of passenger locomotives leading in a connected series by the same builders, up to and including recent designs of the Mountain type, representing the largest passenger

type of present practice. This type has four-wheel leading trucks, eight driving wheels and two trailing wheels. The largest of the Mountain type weights 331,500 lbs. with 240,000 lbs. on driving wheels and produces a tractive effort of 58,000 lbs., or about three times the tractive effort of the first design of the series built during the period of 20 years.

In the year 1898 the engineering and railroad world was interested by the appearance of the largest and most powerful locomotive built up to that time. This was of the Consolidation type with a two-wheel leading truck and eight driving wheels. This locomotive was built in Pittsburgh, and for a number of years was the largest and most powerful of its type, and the largest and most powerful locomotive in the world. Its total weight is 330,000 lbs., weight on drivers 208,000 lbs. and tractive effort 53,300 lbs.

Today the most powerful freight locomotive has two leading and two trailing wheels and 24 driving wheels. It gives a tractive effort of 160,000 lbs. and weights 410 tons. This locomotive has hauled a train of 251 freight cars weighing 17,912 tons, exclusive of the locomotive. The total length of the train was 1.6 miles, the maximum speed attained was 14 miles per hour. This required a maximum drawbar pull of 130,000 lbs. This locomotive has six cylinders and three groups of driving wheels.

A freight locomotive has recently been built having two cylinders and a single group of driving wheels which develops a tractive effort of 84,500 lbs. Such has been the progress in capacity.

This progress has been rapid, perhaps somewhat too rapid with respect to improvements in operating facilities and progress in other features of railroad equipment. It has been rendered possible by corresponding developments of factors making for greater efficiency in boilers and in engines. During the past 20 years in this country locomotive development in capacity and in efficiency, particularly during the past five years with respect to efficiency, has been remarkable, and is worthy of record with progress in marine and stationary engineering.

In Europe the relatively high cost of fuel led to efforts to improve efficiency before this problem aroused serious attention in this country, but physical limitations more rigidly restricted the size and weight of locomotives in Europe. Our problem is to secure maximum efficiency combined with great size, great weight and great power which is more difficult. Since the development in the size and weight has been tremendous, even though these limits may not yet have been reached, it is now appropriate to concentrate on efficiency.

For a number of years the physical capacity of the fireman to shovel horsepower through the fire door determined the capacity of the locomotive at speeds. Mechanical stokers have removed that limitation. It is now possible to fire six tons, and more, of coal per hour into a locomotive firebox. This has changed the problem into one of getting the maximum amount of heat out of the coal and using it economically in the cylinders. With the large figures now prevailing for drawbar pull and weight it is fitting that clostest attention should be given to the best possible use of every pound of metal and every pound of coal. Due to recent application of several economy producing and capacity increasing factors great improvements have already been made with promise of more to come.

Among these economy producing and capacity increasing factors are the following improvements:

- Boiler design in the relationships of the factors making up heating surface;
- Firebox design;
- Front end design, draft appliances, exhaust nozzles;
- Ashpan design as to air openings;
- Superheating;
- Compounding;
- Feedwater heating;
- Firebrick arches and circulating supporting tubes;
- Valve gear;
- Detail design to secure reduced weight of reciprocating parts and other parts;
- Use of high-grade alloy steels to reduce weights;
- Mechanical stokers;
- Labor-saving devices for the engineman and fireman;
- Improved counterbalancing to permit of greater weight on driving wheels by reducing dynamic stresses.

And yet to come is powdered fuel with possibilities unknown in scope and in importance. Powdered fuel is in reserve, promising the ideal method of complete combustion under control more perfect than is possible with present methods other than oil burning and perhaps with economies impossible to obtain with oil.

PROGRESS IN EFFICIENCY

Valuable comparisons may be drawn from the best results of ten years ago and of today. At the Louisiana Purchase Exposition in 1904 the tests made by the Pennsylvania Railroad revealed important figures concerning locomotive performance at that time.

It was shown to be possible to obtain equivalent evaporation from and at 212 deg. of 16.4 lbs. of water per sq. ft. of heating surface, indicating the power of locomotive boilers when forced. It was shown that when the power was low, the evaporation per pound of coal was between 10 and 12 lbs., whereas the evaporation declined to approximately two-thirds of these values when the boiler was forced. These results compared favorably with those obtained in good stationary practice, whereas the rate of evaporation in stationary practice lies usually from 4 to 7 lbs. of water per sq. ft. of heating surface per hour. In steam consumption the St. Louis tests showed a minimum of 16.6 lbs. of steam per i. hp. per hour. In coal economy the lowest figure for coal per dynamometer horsepower was 2.14 lbs. These records were made after the superheater had become a factor in locomotive practice and they represent economies attained by aid of the superheater in one of its early applications. This is important in the light of the recent development of the superheater. These remarkable figures have never received the attention which they deserve from engineers. They serve, however, to show that 10 years ago a steam locomotive had attained results which were worthy of the best attention of the engineers of the time. Since then greater progress has been made and today locomotives of larger capacity than those concerned in the St. Louis tests have given better results.

Voluminous records of recent investigations of locomotive performance taken from the Pennsylvania Railroad test plant at Altoona show that the best record of dry fuel per i. hp. hour down to the present date is 1.8 lbs., with a large number of less than 2 lbs., while the best performance in dry steam per i. hp. hour is 14.6 lbs. with a large number less than 16 lbs. A reduction of 10 per cent in fuel and 12 per cent in water is remarkable as the result of a development of 10 years. This coal performance was recorded by a class E6S Pennsylvania Railroad locomotive while running at 320 r. p. m. and developing 1,245.1 i. hp. The same locomotive gave a fuel rate of 1.9 lbs. while running at the same speed and developing 1,750.9 i. hp. The best water rate was given by a class K2SA Pennsylvania Railroad locomotive while running at 320 r. p. m. and developing 2,033.1 i. hp. These high powers indicate that the locomotives were not coddled as to output of power in order to show high efficiencies, but that high efficiencies accompany actual conditions of operation in severe service. As to power capacity expressed in terms of evaporation, it is interesting to note that the maximum equivalent evaporation from and at 212 deg. per sq. ft. of heating surface per hour on the Altoona test plant is 23.3 lbs. These figures of high efficiency were obtained from locomotives which represented not only very careful, general and detail design, but their design included several of the improvements making for greater capacity and higher efficiency.

Having in mind the facts that steam locomotives are power plants on wheels, built to meet rigid limitations of weight, both static and dynamic, and that the use of condensers is impossible, engineers in general must admit the high character of the work of locomotive designers which has attained these results.

Greater efficiency, which is revealed on the test plant and through reports of engineers, would be important because it proves that progress is being made in the possibilities of locomotive performance. Improvement which is revealed by operating statistics and which, therefore, appears in the records of the treasurer's office is the real test in this case. It is important to know that increased power of locomotives, attained largely through the development of economy-producing and capacity-increasing factors, has produced results which the financial reports of railroads prove beyond question. A recently published list of train tonnage on 45 prominent railroads indicates that 16 of these roads have increased their average freight trainloads by over 30 per cent during the last five years. Credit must be given to the improvement in the locomotive for most of this development. These figures reveal the value of increased power and efficiency of steam locomotives and the end is not yet in sight.

WHAT REMAINS TO BE DONE

American locomotive development to its present state would have been impossible without the use of the improvements already mentioned. It is believed that all these are capable of still further development, making for still greater economy in the use of fuel and, therefore, promising greater power capacity. It is the object of the committee to present these possibilities for discussion by those who are engaged in perfecting and improving steam locomotive practice in this country. It is the hope of the committee that engineers who are devoting their attention to the design of locomotives as a whole and those who are engaged in the development of the various details which have contributed to the high efficiency of the steam locomotive of today will discuss the progress of the recent past and reveal possibilities for future development and improvement in capacity and efficiency.

—Railway Age Gazette.

WOOD USED and WASTED

A southern wood working paper prints the following interesting comment on the use and waste of wood:

"The relative amount of wood used and wasted has been determined. In the logging process, 13 per cent of the standing tree is left in the stumps and tops, leaving 87 per cent to go to the saw mill. The various forms of waste at the saw mill constitute about 43 per cent of the original tree, so that the rough boards consitute the remaining 44 per cent. Most of the saw mill waste is unavoidable, it is asserted, and due to economic conditions; the millmen say they take out all they can afford to.

"Seasoning reduces this to 42 per cent. After planing and other finishing processes, the finished lumber forms only 39 per cent of the tree. The waste involved in building the house amounts to 4 per cent more, so that the proportion of the original tree which finds itself finally in the finished dwelling is not more than 35 per cent.

"But all of the two-thirds need not be wasted. Some of it at least should go into by-products. The bulk of the waste, such as tops, bark, slabs, and edgings, can be made into charcoal, turpentine, tannic acid, wood alcohol, acetate of lime, pulp and paper, and even the sawdust is made into wood alcohol and grain alcohol, and used in different forms for fuel."

"The great waste of wood in manufacture is now countered, to some extent, by the fact that many industries use odds and ends from other factories, which formerly went to waste.

"Every class of wood user is making use of material that formerly was considered waste. The manufacturers of planing mill products no longer burn shavings and sawdust merely to get rid of it, but sell it for bedding, packing for refrigerator cars, etc.; while the larger slabs and other pieces go into laths or bundles of kindlings.

"Spruce and hemlock slabs and edgings are sometimes sold to sulphite pulp manufacturers.

"The general millwork establishment in cities utilize most of their short pieces and odd lengths in one way or another even to the turning of small pieces of beech into wooden button forms, clear hardwood short pieces into novelties, mirror and brush backs.

"Several minor industries now depend upon the waste from the major industries for part of their raw material. Toy and novelty manufacturers frequently obtain their stock from the fixture, furniture and general millwork men; camera works obtain the small blocks from the manufacturer of billiard cues; manufacturers of small chair sleds and toy wagons use odds and ends from furniture establishments; while the producers of small mallets and handles obtain much stock from large vehicle establishments."—American Bulletin.

HOW TO TELL IF A CROWN SHEET HAS BEEN HOT

Low water, however caused, always produces excessive heating, and if the temperature rises sufficiently to weaken the material failure may occur by stripping of the stay bolts or rupture of the sheets by bulging between them, or otherwise. If the temperature has raised the material to a low or bright-red color, this can be readily determined by superficial inspection. While the fire side will show red rust or a black color, the water or steam side will invariably show a typical steel-blue scale, which will not disappear even after years, as it is a so-called rustless coating. If this be once oiled it will always be distinguishable, even if the plates had been exposed to moisture and gases for years. The color of this scale will depend somewhat upon the temperature at which it was produced, being brightest at those points where temperature was the highest. Carefully made tests, with autographic diagrams of such material will again demonstrate changes of properties which are very characteristic.

The yield point will be found very low, while the diagram will show a material drop of curve just after the yield point. The elongation will, however, as a rule, be materially increased, with a diminution of tenacity. Nicked and quenched bending tests will again show marked difference between strips cut from the sheet at points which in one case were overheated or were above the low-water line, and in others were taken from a part below this line. The fracture will also be materially different. To demonstrate the temperature at which the plates happened to be at the instant of explosion, it is necessary to cut strips from points of the overheated plate below the water level. These strips polished on the edges are then held in a clear fire so that one end remains cold while the other is heated to a dull yellow or a very bright red. This temperature being reached, the bars are withdrawn, and while one is rapidly plunged with one end into a pot of boiling water, the other is allowed to cool in air, but not in contact with wet metal or stone. When the piece which had been immersed in boiling water about one inch deep has become nearly cold, below blue heat, it is plunged into cold water.

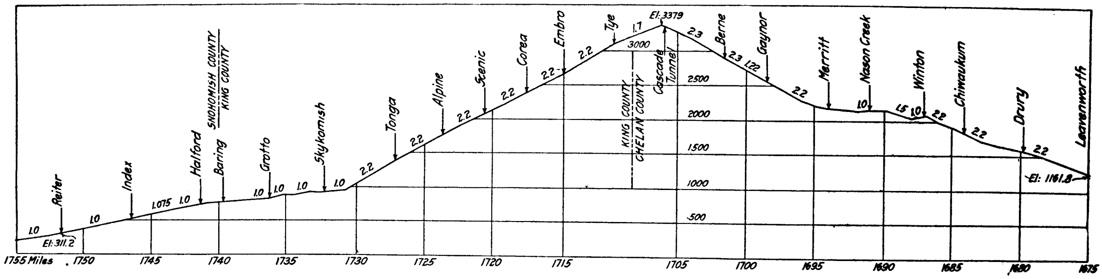
On the polished edges of both bars will be

(Continued on Page 9)

Passenger Locomotives for the Great Northern

Pacific and Mountain Types Used in Hauling Twelve-Car Trans-continental Trains Over the Heaviest Grades

THE Great Northern has obtained very satisfactory service from 25 Pacific and 15 Northern or Mountain type locomotives delivered to that road about a year ago by the Lima Locomotive Corporation, Lima, Ohio. The Pacific type locomotives are used on the transcontinental trains between St. Paul, Minn., and Cut Bank, Mont., a distance of about 1,072 miles. The first locomotive district is one of 408 miles, from St. Paul to Devil's Lake, N. D., the crews being changed about 217 miles out of St. Paul. The next district between Devil's Lake to Williston, N. D., a distance of 239 miles, the crews being changed 118 miles from Devil's Lake; the third is from Williston to Havre, Mont., a distance of 309 miles, the crews being changed at Glasgow, about half way. The fourth and last district on which the Pacific type locomotives are used is from Havre to Cut Bank, Mont., a distance of 129 miles. This portion of the road is in the foot hills of the Rocky mountains and considerable stretches of one per cent grade are encountered throughout, part of the profile being shown in one of the illustrations. The accompanying table gives more detailed information concerning these runs:

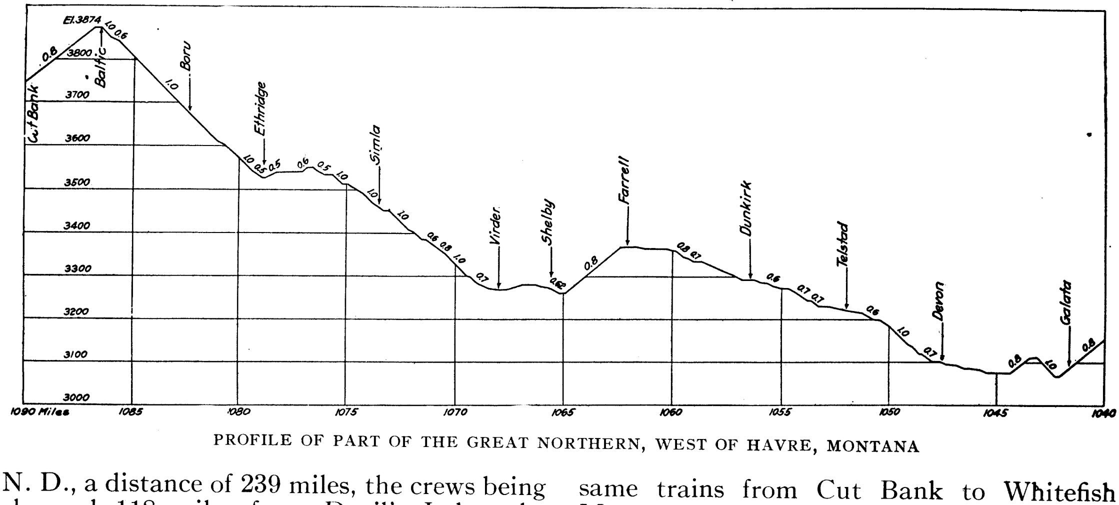


PROFILE OF THE GREAT NORTHERN FROM LEAVENWORTH, WASH., THROUGH THE CASCADE TUNNEL

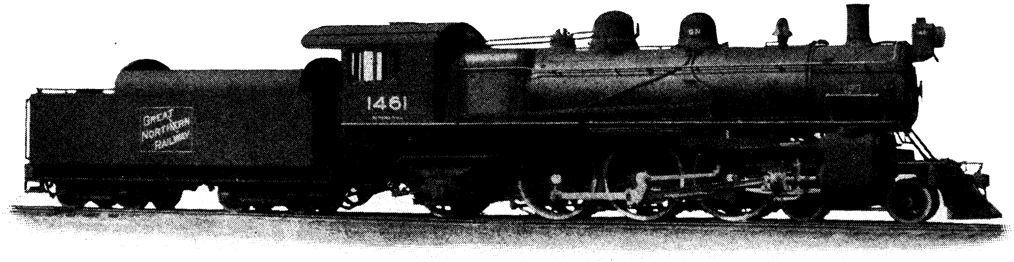
TIME TABLE FOR THE PACIFIC TYPE LOCOMOTIVES

Stations	Distances, miles	Schedule Stops	No. of cars	Max. grade, per cent	Time	Average speed, m. p. h.
St. Paul to Devil's Lake	408	8	11 to 12	.72	11 h. 25 m.	35.7
Devil's Lake to Williston	239	5	11 to 12	.72	6 h. 35 m.	34.3
Williston to Havre	309	5	11 to 12	....	8 h. 50 m.	34.8
Havre to Cut Bank	129	None	11 to 12	1.	4 h. 10 m.	30.

The Mountain type locomotives haul these same trains from Cut Bank to Whitefish, Mont., a distance of 129 miles. This division runs through the Rocky Mountains in the vicinity of Glacier Park, and one per cent westbound and 1.8 per cent east bound grades are encountered. Prior to putting on this type of engine in this service it was necessary to provide a helper on the eastbound run of this division for a distance of 18 miles between Essex and Summit. This helper service has



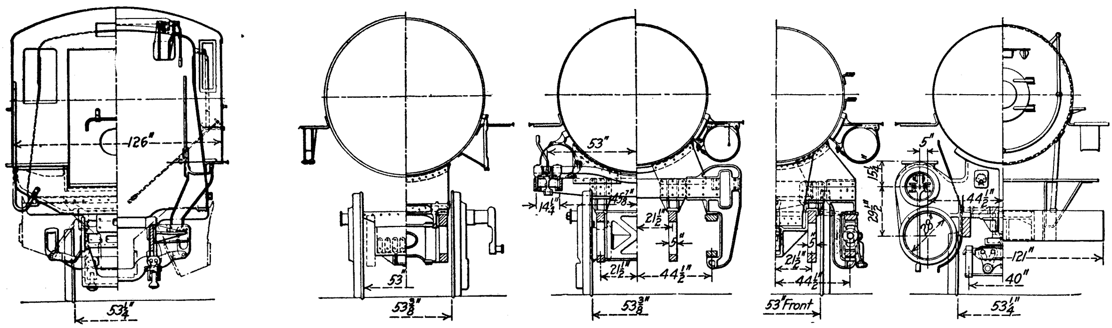
PROFILE OF PART OF THE GREAT NORTHERN, WEST OF HAVRE, MONTANA



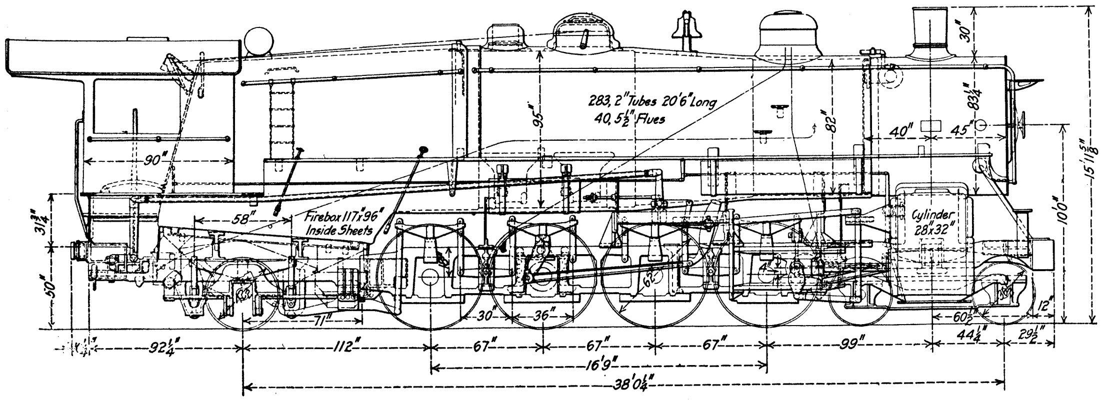
PACIFIC TYPE LOCOMOTIVE FOR THE GREAT NORTHERN

been entirely eliminated without a change being made in the time table, the Mountain type engines handling the trains at a speed of 17 to 20 m. p. h. on the 1.8 per cent grade.

The Mountain type engines have also been placed in service over the Cascade mountains,



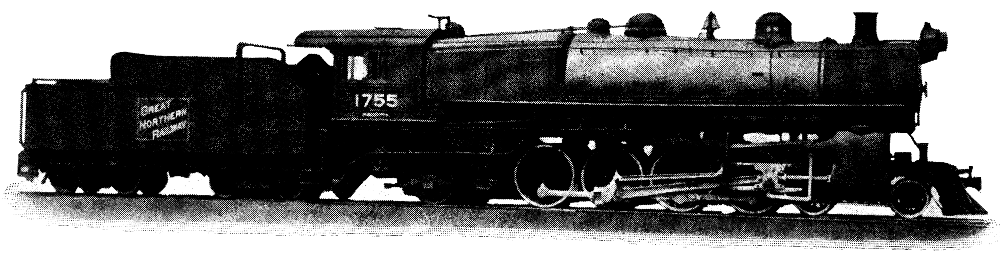
where the grade is 2.2 per cent, as shown in the accompanying profile. It will be noted that this grade is somewhat broken for a distance of 32 miles going west, whereas it is



GENERAL ARRANGEMENT OF THE MOUNTAIN TYPE LOCOMOTIVE FOR THE GREAT NORTHERN

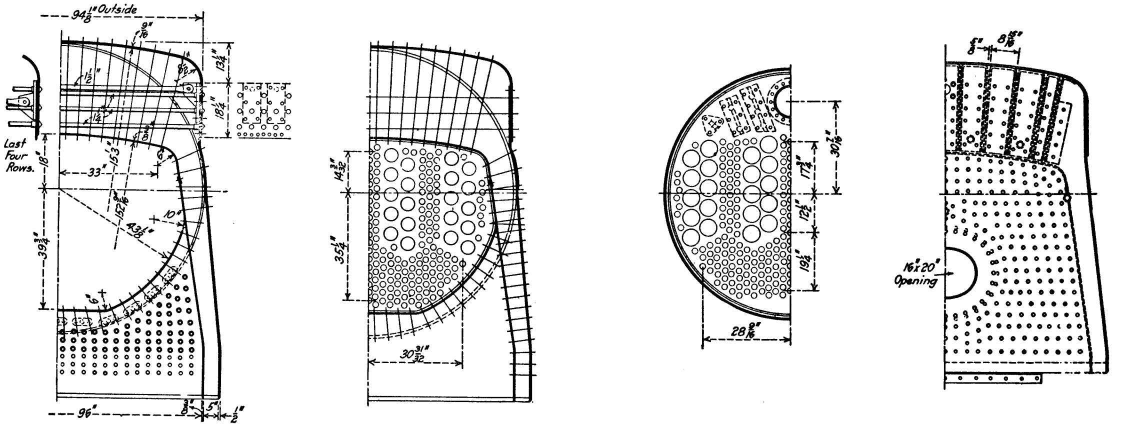
almost continuous running east bound for a distance of 25 miles. In this case, as before, the use of these engines has eliminated the helper service, and they maintain a speed of 15 m. p. h. up this grade with the transcontinental trains. These engines on this hill are burning oil for fuel. Both the Pacific and Mountain type engines are said to be very good steamers and are giving an economical fuel and water performance.

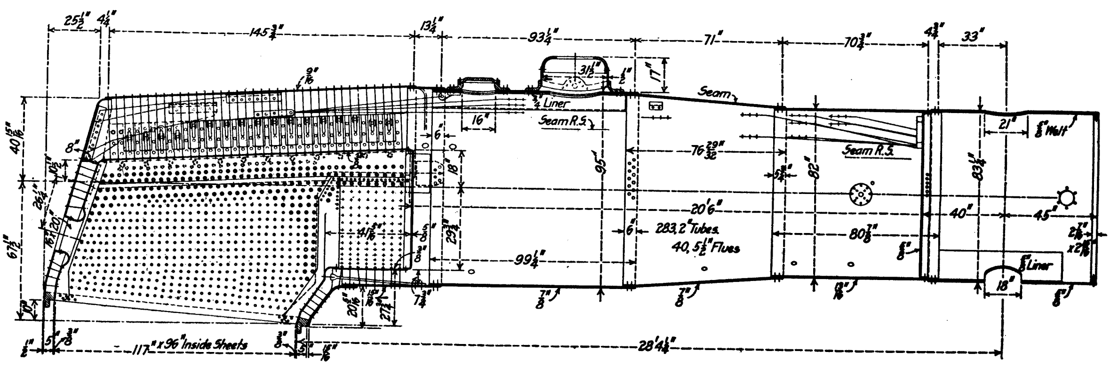
The Mountain type locomotives weigh 326,000 lbs. in working order and have a tractive effort of 61,900 lbs. They carry a boiler pressure of 180 lbs., and have 28 in. by 30 in. cylinders and 62 in. driving wheels. They are equipped with Emerson superheaters which provide a superheating surface of 1,075 sq. ft. The rigid wheel base of these engines is 16 ft. 9 in. The distance between the tires of the forward pair of drivers is 53 in., while



MOUNTAIN TYPE LOCOMOTIVE FOR PASSENGER SERVICE ON THE GREAT NORTHERN

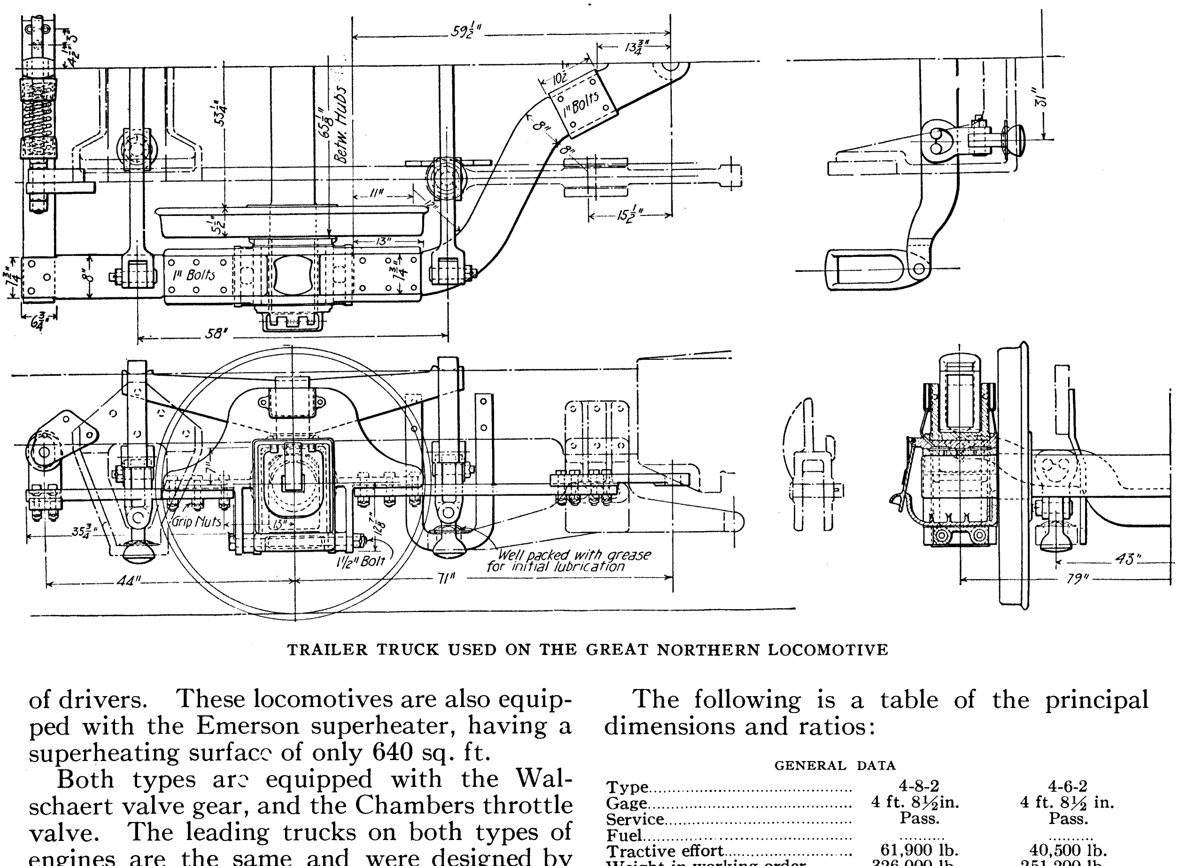
the distance between the other drivers is 53⅜ in. The two leading pairs of drivers are equalized with the leading truck, while the two back pairs are equalized with the trailing truck. The forward spring hangers of the first set of driving springs support a transverse equalizer, from the middle of which is swung a longitudinal equalizer with its fulcrum on a casting attached to the guide yoke frame brace and to a waste sheet as shown in in the elevation drawings. The other end of this equalizer is hung from a second longitudinal equalizer at a point just back of the cylinder casting. This second equalizer has its fulcrum on the leading truck center casting and its forward end is attached to the front buffer casting. This construction gives the front part of the frame ample support and tends to reduce frame breakages back of the cylinder castings. The frame is made continuous from the splice in the rear of the fourth pair of drivers through to the buffer casting. It is 5 in. wide and is braced by three frame braces and three cross bearers. The main journals on these engines are 22 in. long.





BOILER USED ON THE GREAT NORTHERN MOUNTAIN TYPE LOCOMOTIVE

The Pacific type engines weigh 251,200 lbs. in working order, and have a tractive effort of 40,500 lbs. They carry a boiler pressure of 210 lbs. and have 23½ in. by 30 in. cylinders; the drivers are 73 in. in diameter. The distance between tires on the forward pair of drivers is 53 in., while that for the main drivers is 53⅜, and for the back drivers 53¼ in. All three pairs of drivers are equalized with the trailing truck, the cylinder casting resting directly on the center plate of the forward truck. The frames are 5 in. in width, the same as the Mountain type engines, and they are made in one piece from the front buffer to the splice in the rear of the back set partially equipped with Tate flexible stay bolts. The boiler of the Mountain type locomotive has a combustion chamber about 41 in. deep, which provides a tube length of 20 ft. 6 in. The Pacific locomotive, however, is not equipped with a combustion chamber and has a tube length of 21 ft. The outside diameter of the first ring of the Mountain type boiler is 82 in., while that for the Pacific type is 72 in. The cylinders of both engines are of similar design, the steam passages being contained in the cylinder saddle. The valves are provided with ⅝ in. bushings, those for the Mountain type being 16 in. inside diameter.



TRAILER TRUCK USED ON THE GREAT NORTHERN LOCOMOTIVE

of drivers. These locomotives are also equipped with the Emerson superheater, having a superheating surface of only 640 sq. ft.

Both types are equipped with the Walschaert valve gear, and the Chambers throttle valve. The leading trucks on both types of engines are the same and were designed by the railroad company. They have an 86 in. wheels base and support a load of 50,000 lbs. in the case of the Mountain type locomotive and 55,000 lbs. in the case of the Pacific type.

The trailing truck was designed by the Lima Locomotive Corporation and is known as the Austin truck. It is designed to simplify the removal and replacement of journal boxes and to provide a self-centering radial action of sufficient stiffness to prevent undesirable swinging of the rear end of the locomotive.

The boilers of both the Mountain type and Pacific type are of the Belpaire type and are

The following is a table of the principal dimensions and ratios:

GENERAL DATA

Type	4-8-2	4-6-2
Gage	4 ft. 8½in.	4 ft. 8½ in.
Service	Pass.	Pass.
Fuel	....	....
Tractive effort	61,900 lb.	40,500 lb.
Weight in working order	326,000 lb.	251,200 lb.
Weight on drivers	218,000 lb.	150,700 lb.
Weight on leading truck	50,000 lb.	55,000 lb.
Weight on trailing truck	58,000 lb.	52,700 lb.
Weight of engine and tender in working order	478,000 lb.	420,000 lb.
Wheel base, driving	16 ft. 9 in.	13 ft. 0 in.
Wheel base, total	38 ft. 0 in.	33 ft. 9 in.
Wheel base, engine and tender	71 ft. 4 in.	66 ft. 9 in.

RATIOS

Weight on drivers ÷ tractive effort	3.52	3.51
Total weight ÷ tractive effort	5.27	6.17
Tractive effort × diam. drivers ÷ total equivalent heating surface*	623.	733.
Total equivalent heating surface* ÷ grate area	79.	75.7
Firebox heating surface ÷ total equivalent heating surface*, per cent	5.5	5.1

Weight on drivers ÷ total equivalent heating surface.*	35.4	35.3
Total weight ÷ total equivalent heating surface*	53.	62.
Volume both cylinders	22.78	15.04
Total equivalent heating surface* ÷ vol. cylinders	270.	268.
Grate area ÷ vol. cylinders	3.43	3.54
CYLINDERS		
Kind	Simple	Simple
Diameter and stroke	28″ x 32″	23½″ x 30″
VALVES		
Kind	Piston	Piston
Diameter	16″	12″
Outside lap	1⅛″	1″
Lead in full gear	¼″	¼″
WHEELS		
Driving, diameter over tires	62″	73″
Driving, thickness of tires	3″	3½″
Driving journals, main, diameter and length	11″ x 22″	10½″ x 16″
Driving journals, others, diameter and length	10″ x 12″	9½″ x 12″
Engine truck wheels, diameter	36½″	36½″
Engine truck, journals	6″ x 12″	6″ x 12″
Trailing truck wheels, diam.	42½″	49″
Trailing truck, journals	8″ x 14″	8″ x 14″
BOILER		
Style	Conical Belpaire	Straight Belpaire
Working pressure	180 lb.	210 lb.
Outside diameter of first ring	82″	72″
Firebox, length and width	117″ x 96″	116″ x 66¼″
Firebox, water space	5″	5″
Tubes—number and outside diameter	283—2″	155—2¼″
Flues, number and outside diameter	40—5½″	32—5½″
Tubes, length	20 ft. 6″	21 ft.
Heating surface, tubes	4,200 sq. ft.	2,870 sq. ft.
Heating surface, firebox	340 sq. ft.	206 sq. ft.
Heating surface, total	4,540 sq. ft.	3,076 sq. ft.
Superheater heating surface	1,075 sq. ft.	640 sq. ft.
Total equivalent heating surface*	6,153 sq. ft.	4,036 sq. ft.
Grate area	78 sq. ft.	53.3 sq. ft.
TENDER		
Tank	Wat. bot.	Wat. bot.
Wheels, diameter	36½″	36½″
Journals, diameter and length	5½″ x 10″	5½″ x 10″
Water capacity	8,000 gal.	8,000 gal.
Coal capacity	15 tons	15 tons

*Total equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

Railway Affairs in Other Countries

The Railway News of London has compiled figures showing the number of railway employees of great Britain that have enlisted for war, a total of over 35,000 for eleven companies. Allowing for the figures of other companies not yet published, the total must be at least 40,000 for the United Kindgom. The North Eastern men were formed into a special battalion. This company's contribution of 5,000 represents about one-tenth of the company's force. The figures for the principal companies are as follows:

Great Central	1,300	London Brighton	1,300
Great Eastern	1,500	Midland	3,000
Great Northern	2,500	North-Eastern	5,000
Great Western	7,600	S. Eastern & Chatham	1,500
London & N.-Western	9,400	Tube Lines	150
London & S.-Western	2,000		
		Total	35,250

Since the declaration of war on Germany by Great Britain early in August, completely equipped ambulance trains have been prepared by a number of the railroads of Great Britain and turned over to the war office for use in transporting wounded soldiers from the coast to hospitals at various inland points. These trains were made up of existing rolling stock, the interior of which was altered and refitted in accordance with plans approved by the war office; the work of conversion was conducted with such despatch that some of the trains were ready for service by August 14. Each train is made up of from nine to ten vestibule coaches and in effect constitutes a completely equipped hospital capable of caring for about 100 wounded men, together with accommodations for the necessary staff of doctors, nurses and orderlies. Each ward car will accommodate from 16 to 20 men on spring cots, which are arranged in two tiers on either side of the car. A treatment car is provided, one end of which contains a well equipped pharmacy. Next to the pharmacy is an operating room opening from a side corridor, in the fitting of which special care has been taken to provide for proper sanitation. A third compartment is fitted up as an office, and the remainder of the car is arranged for the storage of clean and dirty linen. The trains all include dining or kitchen cars, and ample mess room and sleeping accommodations for the entire staff. Everything possible has been done to promote comfort and convenience, some of the trains having telephone installations for communication between the various cars.—Railway Age Gazette.

(Continued from Page 4)

found scale and heat colors, the temperatures producing them being well established. These bars are then carefully nicked at points opposite every change of color and then broken off at these nicks. By comparing these fractures and their scale and color with those obtained from pieces cut from the overheated plates, the temperature at which they were at the instant of explosion can be determined with great accuracy. Having thus determined the temperature at which the sheets were during operation, it is also known whether the metal was sufficiently soft to bulge off or strip from the stay bolts; examination of plates and bolts will verify the conclusion.—Railway and Locomotive Engineering.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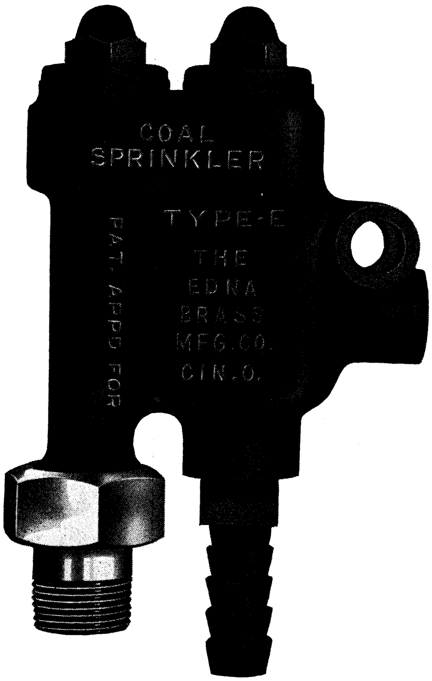

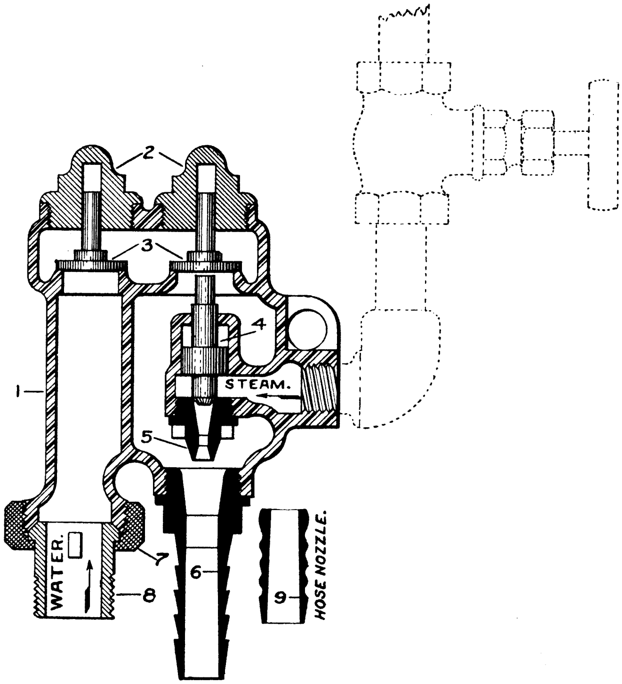

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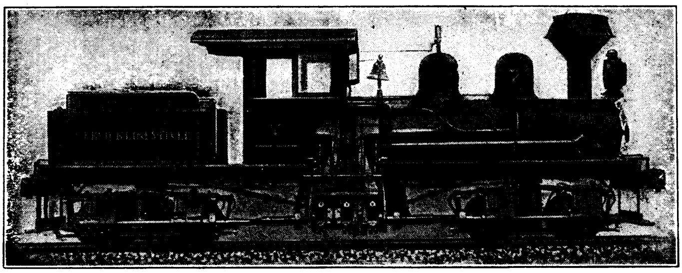

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	Tonnage	Type	Gauge	Location	Reference No.
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1	55	Shay	56½″	New Mexico	0832
1	65	Shay	36 ″	New Mexico	083
1	65	Shay	56½″	New Mexico	0831
1	30	Mogul	56½″	Alabama	133
1	40	American	56½″	Alabama	134
1	24	Shay	42 ″	Pennsylvania	138
1	24	Shay	36 ″	Pennsylvania	0138
1	30	Shay	56½″	Pennsylvania	139
1	42	Shay	56½″	Louisiana	140

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